CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: 12/13/2021 – updated 01/05/2021

TO: Bryan Hartsook – SER

FROM: Nicole Krueger – SER Nicole Krueger

SUBJECT: Water Quality-Based Effluent Limitations for Johnsonville LLC
WPDES Permit No. WI-001759-10

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from Johnsonville in Sheboygan County. This industrial facility discharges to the Sheboygan River, located in the Sheboygan River Watershed in the Sheboygan River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report. Based on our review, the following recommendations are made on a chemical-specific basis:

Outfall 002:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD_5						3,4
March – May	464 lbs/day		262 lbs/day	232 lbs/day		
June – November	464 lbs/day		88 lbs/day	**88 lbs/day**		
Dec – February	464 lbs/day		219 lbs/day	**219 lbs/day**		
TSS	564 lbs/day			282 lbs/day		1,3,5
Phosphorus						5,6
LCA Interim Limit				1.0 mg/L		
HAC Interim Limit				0.8 mg/L		
Final WQBEL				0.3 mg/L	0.1 mg/L 0.425 lbs/day	
Oil & Grease	166 lbs/day			83 lbs/day		1,3
pH	9.0 s.u.	6.0 s.u.				1
Bacteria						3,7
Interim Limit Fecal Coliform	400 #/100 mL			400 #/100 mL geometric mean		
Final Limit *E. coli*				126 #/100 mL geometric mean		
Ammonia Nitrogen	8.0 mg/L			4.0 mg/L		1,3
Total Nitrogen	194 mg/L			134 mg/L		1,3
Chloride						1
March – May	1,500 mg/L		1,500 mg/L 6,320 lbs/day	1,500 mg/L		
June – November	1,300 mg/L		860 mg/L 3,230 lbs/day	860 mg/L		
Dec – February	1,100 mg/L		990 mg/L 3,720 lbs/day	990 mg/L		
Temperature						1,2

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Acute WET						8,9
Chronic WET				4.0 TUc		8,9

Outfall 003

Parameter	Footnotes
Flow Rate	1,2
Chlorine	2
Phosphorus	2,5

Footnotes:

1. No changes from the current permit.
2. Monitoring only.
3. Categorical limits based on ch. NR 258, Wis. Adm. Code were evaluated in the technology-based effluent limits memo (11/09/2021) based on updated production data. There are no changes based on categorical limits from the current permit.
4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
5. A Total Maximum Daily Load (TMDL) is being developed for the Northeast Lakeshore to address water quality impairments within the TMDL area. This TMDL will likely result in limitations for phosphorus and TSS that must be included in WPDES permits, which may be different than those calculated for this reissuance. TMDL-derived limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.
6. Under the phosphorus MDV, a level currently achievable (LCA) interim limit of 1.0 mg/L should be effective upon permit reissuance. A compliance schedule may be included in the permit until the highest attainable condition (HAC) limit of 0.8 mg/L can be met. The final WQBELs remain at 0.3 mg/L as a monthly average and 0.1 mg/L as a six-month average, as well as a respective mass limit.
7. The fecal coliform interim limit will continue to be effective after the *E. coli* limits become effective. *E. coli* limits will apply at the end of the compliance schedule during the disinfection season of May through September. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.
8. 2/permit term acute WET and annual chronic WET tests are recommended. The Instream Waste Concentration (IWC) to assess chronic test results is 25%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 30%, 10%, 3% & 1% and the dilution water used in WET tests conducted on Outfall 002 shall be a grab sample collected from the Sheboygan River.
9. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Nicole Krueger at Nicole.Krueger@wisconsin.gov or Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, Thermal Table & Outfall Map

PREPARED BY: Nicole Krueger – SER

E-cc: Curt Nickels, Wastewater Engineer – SER
Diane Figiel, Water Resources Engineer – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for Johnsonville LLC

WPDES Permit No. WI-0001759-10

Prepared by: Nicole Krueger

PART 1 – BACKGROUND INFORMATION

Facility Description

Johnsonville LLC ("Johnsonville") is headquartered in central Sheboygan County and operates two activated sludge wastewater treatment plants (WWTP). The WWTPs treat process wastewater from four production/processing facilities, cooling tower and boiler blowdown from the ammonia systems at the production facilities, employee sanitary wastes, and sanitary wastes from the unincorporated community of Johnsonville. Effluent is discharged to the east bank of the Sheboygan River through the combined Outfall 002.

Noncontact cooling water from the Riverside facility is discharged through the separate Outfall 003 to the west bank of the Sheboygan River.

Attachment #2 is a map of the area showing the approximate location of Outfalls 002 and 003.

Existing Permit Limitations

The current permit, expiring on 03/31/2022, includes the following effluent limitations and monitoring requirements.

Outfall 002

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1
BOD_5						2
March – May	464 lbs/day		262 lbs/day	232 lbs/day		
June – November	464 lbs/day		88 lbs/day	232 lbs/day		
Dec – February	464 lbs/day		219 lbs/day	232 lbs/day		
TSS	564 lbs/day			282 lbs/day		2
Phosphorus						3
Interim				1.0 mg/L		
Final				0.3 mg/L	0.1 mg/L 0.525 lbs/day	
Oil & Grease	166 lbs/day			83 lbs/day		
pH	9.0 s.u.	6.0 s.u.				4
Fecal Coliform May – September	400#/100 mL			400#/100 mL geometric mean		
Ammonia Nitrogen	8.0 mg/L			4.0 mg/L		3
Total Nitrogen	194 mg/L			134 mg/L		3
Chloride						

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
March – May	1,500 mg/L		1,500 mg/L 6,320 lbs/day	1,500 mg/L		
June – November	1,300 mg/L		860 mg/L 3,230 lbs/day	860 mg/L		
Dec – February	1,100 mg/L		990 mg/L 3,720 lbs/day	990 mg/L		
Temperature						1
Copper						1
Hardness						1
Acute WET						5
Chronic WET				4.0 TUc		5

Outfall 003

Parameter	Footnotes
Flow Rate	1
Temperature	1

Footnotes:

1. Monitoring only.
2. The technology-based effluent limits for the mass BOD_5 and TSS limits are evaluated in a separate memo.
3. A compliance schedule is in the current permit to meet the final WQBEL by March 30, 2026.
4. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
5. Acute and chronic WET tests are required 1x/yearly. The instream waste concentration (IWC) for chronic tests is 25%.

Receiving Water Information

- Name: Sheboygan River
- Waterbody Identification Code (WBIC): 50700
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply. (Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.)
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q_{10} and 7-Q_2 values are from USGS for Station #04085630 updated 01/30/2018, where Outfall 001 is located.
  7-Q_{10} = 11.8 cfs (cubic feet per second)
  7-Q_2 = 18.7 cfs

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
7-Q_{10} (cfs)	19	20	31	68	31	19.5	14.7	13.5	12.5	15.4	23	22
7-Q_2 (cfs)	40	41	86	122	64	45	28	24	23	30	44	44

- Hardness = 330 mg/L as $CaCO_3$. This value represents the geometric mean of data from WET testing from 07/31/2018 to 04/06/2021.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 25%.
- Source of background concentration data: Metals data from the Sheboygan River at Station ID 603217 is used for this evaluation. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen are described later.
- Multiple dischargers: Outfall 002 and 003 are 400 feet away from each other, but the mixing zones are not expected to overlap because the smaller quantity discharge (003) is located upstream and on the opposite bank of the Sheboygan River than 002. There are several other dischargers to the Sheboygan River however they are not in the immediate vicinity and the mixing zones do not overlap. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The immediate receiving water is not impaired. The Sheboygan River approximately 15 miles downstream is 303(d) listed as impaired for PCBs and total phosphorus.

Effluent Information

- Flow rate(s):
  Outfall 002
  Maximum annual average = 0.51 MGD (Million Gallons per Day)
  Actual average flow from 04/01/2017 to 09/30/2021 was 0.47 MGD
  Outfall 003
  Maximum annual average = 0.0016 MGD
  Actual average flow from 04/01/2017 to 09/30/2021 was 0.00079 MGD
- Hardness = 241 mg/L as $CaCO_3$. This value represents the geometric mean of data from permit required monitoring for Outfall 002 between 01/05/2020 to 12/07/2020.
- Acute dilution factor used in accordance with s. NR 106.06(3)(c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water source: Private wells.
- Additives: Outfall 002: Suppressor 1157 is added as an anti-foam agent after wastewater treatment. Sulfuric acid and CO_2 for pH adjustment, a polymer and lime for settling, and ferric sulfate for phosphorus removal are used in the wastewater treatment process. Outfall 003: Sodium hypochlorite is added to the water supply which is used for noncontact cooling water.
- Effluent characterization: This facility is categorized as a secondary industry, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus ammonia, chloride, hardness and phosphorus.
- Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled "MEAN EFFL. CONC.". Otherwise, substances with multiple effluent data are shown in the tables below or in their respective parts in this evaluation.

Outfall 002 Effluent Copper Data

Sample Date	Copper µg/L	Sample Date	Copper µg/L	Sample Date	Copper µg/L
01/05/2020	<3.4	05/4/2020	5.3	09/7/2020	3.6
02/4/2020	18	06/1/2020	18	10/5/2020	9.8

03/2/2020	5.2	07/6/2020	5.2	11/2/2020	4.3
04/6/2020	5.9	08/3/2020	3.7	12/7/2020	7.4
1-day P_{99} = 27 µg/L					
4-day P_{99} = 15 µg/L					

"<" means that the pollutant was not detected at the indicated level of detection. The mean concentration was calculated using zero in place of the non-detected results.

Outfall 002 Effluent Chloride Data

	Chloride mg/L
1-day P_{99}	798
4-day P_{99}	639
30-day P_{99}	550
Mean	504
Std	105
Sample size	215
Range	142 – 801

The following table presents the average concentrations and loadings at Outfall 002 from 04/01/2017 to 09/30/2021 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

Parameter Averages with Limits for Outfall 002

	Average Measurement	Average Mass Discharged
BOD_5	5.4 mg/L*	21 lbs/day
TSS	8.2 mg/L*	35 lbs/day
pH field	7.82 s.u.	
Phosphorus	0.35 mg/L	1.16 lbs/day
Ammonia Nitrogen	0.37 mg/L*	
Total Nitrogen	6.11 mg/L	
Oil & Grease	0.31 mg/L*	
Chloride	504 mg/L	

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P_{99}) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q_{10}

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code, (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q_{10} receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards. The mass balance equation is provided below.

$$\text{Limitation} = \frac{(WQC)\,(Qs + (1-f)\,Qe) - (Qs - f\,Qe)\,(Cs)}{Qe}$$

Where:

WQC =Acute toxicity criterion or secondary acute value according to ch. NR 105, Wis. Adm. Code.

Qs = average minimum 1-day flow which occurs once in 10 years (1-day Q_{10}) if the 1-day Q_{10} flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q_{10}).

Qe = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

Cs = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q_{10} method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is not the case for Johnsonville and the limits are set based on two times the acute toxicity criteria.

The following tables list the calculated WQBELs for this discharge along with the results of effluent sampling. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

Outfall 002

RECEIVING WATER FLOW = 9.44 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Chlorine		19.0		38.1	7.6	<20		
Arsenic		340	10	680	136	<5		
Cadmium	241	28.3	0.3	57	11	<0.2		
Chromium	241	3706	3	7412	1482	2.1		
Copper	241	35.6	10	71			27	18
Lead	241	250	3	500	100	<5		
Nickel	241	987	20	1975	395	4.8		

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Zinc	241	260	20	520	104	15.1		
Chloride (mg/L)		757	21	1514			798	801

* The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q_{10} flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

Outfall 003

RECEIVING WATER FLOW = 9.44 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Chlorine		19.0		38.1	7.6	40
Chloride (mg/L)		757	21	1514		<1.8

* The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q_{10} flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

Outfall 002

RECEIVING WATER FLOW = 2.95 cfs (¼ of the 7-Q_{10}), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Chlorine		6.1		28.9	5.8	<20	
Arsenic		152	10	684	137	<5	
Cadmium	175	3.82	0.3	17.0	3.4	<0.2	
Chromium	301	326	3	1532	306	2.1	
Copper	330	28.8	10	99	20		16
Lead	330	88.8	3	409	82	<5	
Nickel	268	120	20	495	99	4.80	
Zinc	330	342	20	1546	309	15.1	
Chloride (mg/L)		395	21	1793			639

* The indicated hardness may differ from the receiving water hardness because the receiving water hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the chronic criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

Outfall 003

RECEIVING WATER FLOW = 2.95 cfs (¼ of the 7-Q_{10}), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	REF. HARD. mg/L	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Chlorine		6.1		7275	1455	40
Chloride (mg/L)		395	21	1793		<1.8

Monthly Average Limits based on Wildlife Criteria (WC)
The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

Outfall 002
RECEIVING WATER FLOW = 12.1 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	0.3	6054	1211	<0.2
Chromium (+3)	3818000	3	62518721	12503744	2.1
Lead	140	3	2246	449	<5
Nickel	43000	20	703806	140761	4.8

Monthly Average Limits based on Human Cancer Criteria (HCC)

Outfall 002
RECEIVING WATER FLOW = 12.1 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3	10	64.0	12.8	<5

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations
Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are required for chlorine for Outfall 003.

Chlorine –

Outfall 002: Johnsonville monitored for chlorine for their permit reissuance application. The sample from 09/17/2021 was reported as 60 µg/L (using the Hach DPD method) which is greater than the calculated WQBELs. The facility does not add chlorine in the treatment process but hypochlorite is added in the sanitation process which is before the wastewater treatment processes. Residual chlorine was resampled and the two samples from 10/25/2021 and 10/28/2021 were reported as <20 µg/L using the ion selective electrode (ISE) method which is subject to fewer interferences. Because chlorine is not expected to be detected above the calculated limits at the outfall, **limits are not recommended but monitoring is recommended in the reissued permit** to determine if limits are needed.

Outfall 003: Johnsonville monitored for chlorine for their permit reissuance application. The sample from 09/17/2021 was reported as 40 µg/L (using the Hach DPD method) which is greater than the calculated WQBELs. Residual chlorine was resampled and the two samples from 12/06/2021 and 12/08/2021 were reported as <20 µg/L using the ISE method which is subject to fewer interferences. **Limits are not recommended but monitoring is recommended in the reissued permit** to determine if limits are needed.

Chloride – Considering available effluent data from the current permit term (04/03/2017 to 09/10/2021) the 1-day P_{99} chloride concentration is 798 mg/L, and the 4-day P_{99} of effluent data is 639 mg/L. These effluent concentrations are below the calculated limits, however there are chloride limits effective in the current permit so limits are recommended to continue. **The current chloride limits are listed in the table below.**

Current Chloride Limits

	Daily Max	Weekly Average	Monthly Average
March – May	1,500 mg/L	1,500 mg/L 6,230 lbs/day	1,500 mg/L
June – November	1,300 mg/L	860 mg/L 3,230 lbs/day	860 mg/L
Dec – February	1,100 mg/L	990 mg/L 3,720 lbs/day	990 mg/L

The calculated limits are less restrictive than the current effective limits. If Johnsonville would like to request an increase to the existing permit limits, an assessment of their effluent data consistent with the requirements of ss. NR 207.04(1)(a) and (c), Wis. Adm. Code, must be provided. This evaluation is on a parameter by parameter basis and includes consideration of operations, maintenance and temporary upsets. Without a demonstration of need for a higher limit in accordance with s. NR 207.04, Wis. Adm. Code, the current limits must be continued in the reissued permit. The Department would be unable to increase the limit due to the lack of need as shown via the antidegradation rule (ch. NR 207, Wis. Adm. Code) because the highest reported concentration was 801 mg/L during the current permit term. **No changes are recommended in any of the permit limits for chloride** for antibacksliding purposes.

PART 3 – BOD AND TSS

In establishing BOD_5 (Biochemical Oxygen Demand) limitations, the primary intent is to prevent a lowering of dissolved oxygen levels in the receiving water below water quality standards as specified in ss. NR 102.04(4)(a) and (b). The 26-lb method is the most frequently used approach for calculating BOD_5 limits when resources are not available to develop a detailed water quality model. This simplified model was developed in the 1970's by the Wisconsin Committee on Water Pollution on the Fox, Wisconsin, Oconto, and Flambeau Rivers. Further studies throughout the 1970's proved this model to be relatively accurate. The model has since then been used by the Department on many occasions when resources are not available to perform a site-specific model. The "26" value stems from the following equation:

$$\frac{26\ {}^{\text{lbs}}/_{\text{day}}}{{}^{\text{ft}^3}/_{\text{sec}}} * \frac{1\,\text{day}}{86{,}400\,\text{sec}} * \frac{454{,}000\,\text{mg}}{\text{lbs}} * \frac{1\,\text{ft}^3}{28.32\,\text{L}} = 4.8 = 2.4 * 2\ {}^{\text{mg}}/_{\text{L}}$$

The 4.8 has been calculated by taking 2.4 which is the number one receives when converting 26 lbs of BOD/day/cfs into mg/L, multiplied by 2.0 which is the change in the DO level. A typical background DO

level for Wisconsin waters is 7 mg/L, so a 2 mg/L decrease is allowed in order to meet the 5 mg/L standard for warm water streams. The above relationship is temperature dependent and an appropriate temperature correction factor is applied. The 26-lb method is based on a typical 24°C summer value for warm water streams. Adjustments for temperature are made using the following equation:

$$k_t = k_{24}\left(0.967^{(T-24)}\right)$$

Where k_{24} = 26 lbs of BOD/day/cfs

Calculations based on Full Assimilative Capacity at 7Q10 Conditions:

$$Limitation(mg/L) = 2.4\left(DO_{stream} - DO_{std}\right)\left(\frac{\left({}_7Q_{10} + Q_{eff}\right)}{Q_{eff}}\right)\left(0.967^{(T-24)}\right)$$

Where:
Q_{eff} = maximum annual average = 0.51 MGD
DO_{stream} = background dissolved oxygen = 7 mg/L
DO_{std} = dissolved oxygen criteria from s. NR 102.04(4) = 5.0 mg/L
${}_7Q_{10}$ = 11.8 cfs
T = Receiving water temperature from s. NR 102.25

Outfall 002

Outfall 002 BOD_5 Limitations

BOD Effluent Limitations (26 LB Method)		March – May	June – Nov	Dec – Feb
Background Information:	7-Q_{10} (cfs)	11.8	11.8	11.8
	River Temperature (°C)	58	69	35
Dissolved Oxygen mg/L:	Effluent	7	7	7
	Background	7	7	7
	Mix DO	7	7	7
	Criteria	5	5	5
Weekly Ave BOD Effluent Limitations	Concentration Limits (mg/L)	**105**	**85.8**	**162**
	Mass (lbs/day)	**448**	**365**	**688**
Current Weekly Ave Limits	Mass (lbs/day)	**262**	**88**	**219**

The current permit limits are more restrictive than the calculated WQBEL limits above. Technology-based effluent limits (TBEL) for BOD_5 are addressed in the TBEL memo dated 11/09/2021 for facilities subject to ch. NR 258 Wis. Adm. Code. **The calculated TBEL limits are the same as in the current permit, so they are recommended to be continued.** See the Expression of Limits section in this memo for additional requirements.

TSS limitations are primarily given to maintain or improve water clarity and are not water quality based. Since there are no WQBEL BOD_5 limits, the TSS limits are addressed in the TBEL memo dated 11/09/2021. **The recommended limits are 564 lbs/day as a daily maximum and 282 lbs/day as a monthly average which are the same as in the current permit.**

Outfall 003

Outfall 003 BOD_5 Limitations

BOD Effluent Limitations (26 LB Method)		**March – May**	**June – Nov**	**Dec – Feb**
Background Information:	7-Q_{10} (cfs)	11.8	11.8	11.8
	River Temperature (°C)	58	69	35
Dissolved Oxygen mg/L:	Effluent	7	7	7
	Background	7	7	7
	Mix DO	7	7	7
	Criteria	5	5	5
Weekly Ave BOD Effluent Limitations	Concentration Limits (mg/L)	**31,471**	**25,363**	**48,320**
	Mass (lbs/d)	**420**	**342**	**645**

The permit reissuance application reported one BOD_5 sample as 32 mg/L on 03/22/2021. Based on this sample, **there is not reasonable potential for BOD_5 limits for Outfall 003. Limits and monitoring are not recommended in the reissued permit.**

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. The current permit has daily maximum and monthly average limits. These limits are re-evaluated at this time due to the following changes:

- Subchapter IV of ch. NR 106, Wis. Adm. Code allows limits based on available dilution instead of limits set to twice the acute criteria.
- The maximum expected effluent pH has changed

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation:

$$ATC \text{ in mg/L} = [A \div (1 + 10^{(7.204 - pH)})] + [B \div (1 + 10^{(pH - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 1220 sample results were reported from 01/03/2017 to 09/30/2021 for Outfall 002. There is limited pH data for Outfall 003, so the pH at both outfalls are assumed to be similar for purposes of calculating the daily maximum ammonia limits. The maximum reported value was 8.72 s.u. (Standard pH Units). The effluent pH was 8.14 s.u. or less 99% of the time. The 1-day P_{99}, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 8.19 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper

ninety ninth percentile for a normally distributed dataset, is 8.18 s.u. Therefore, a value of 8.19 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 8.19 s.u. into the equation above yields an ATC = 5.8 mg/L.

Potential Changes to Daily Maximum Ammonia Nitrogen Effluent Limitations
Subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) specifies methods for the use of the 1-Q_{10} receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q_{10} (estimated as 80 % of 7-Q_{10}) and the 2×ATC approach are shown below.

Daily Maximum Ammonia Nitrogen Determination

	Ammonia Nitrogen Limit mg/L
2×ATC	12
002 1-Q_{10}	75
003 1-Q_{10}	2,212

The 2×ATC method yields the most stringent limits for Johnsonville.

This limit is greater than the current daily maximum limit of 8.0 mg/L which is based on categorical requirements per NR 258 Wis. Adm. Code for meat processing facilities. The updated TBEL memo dated 11/09/2021 also recommends a daily maximum limit of 8.0 mg/L. Therefore, **the current daily maximum limit is recommended to be included in the reissued permit for Outfall 002.**

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)
Weekly and monthly average limits based on chronic toxicity criteria for ammonia are also calculated to determine the weekly and monthly average limits to meet the requirements of s. NR 106.07(3), Wis. Adm. Code.

Weekly average and monthly average limits for ammonia nitrogen are based on chronic toxicity criteria in ch. NR 105, Wis. Adm. Code.

The 30-day chronic toxicity criterion (CTC) for ammonia in waters classified as a Warm Water Sport Fish Community is calculated by the following equation, according to subchapter IV of NR 106, Wis. Adm. Code.

$$CTC = E \times \{[0.0676 \div (1 + 10^{(7.688 - pH)})] + [2.912 \div (1 + 10^{(pH - 7.688)})]\} \times C$$

Where:

pH = the pH (s.u.) of the receiving water,
E = 0.854,
C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Present), or
$C = 1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Absent), and
T = the temperature (ºC) of the receiving water – (Early Life Stages Present), or

T = the maximum of the actual temperature (ºC) and 7 - (Early Life Stages Absent)

The 4-day criterion is equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q_{10} (4-Q_3, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q_5 (estimated as 85% of the 7-Q_2 if the 30-Q_5 is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature; 100% of the flow is used if the Temperature ≥ 16 ºC, 25% of the flow is used if the Temperature < 11 ºC, and 50% of the flow is used if the Temperature ≥ 11 ºC but < 16 ºC.

Section NR 106.32 (3), Wis. Adm. Code, provides a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 ºC, during the winter and spring months. Burbot, an early spawning species, are not believed to be present in the Sheboygan River, based on conversations with local fisheries biologists. So "ELS Absent" criteria apply from October through March, and "ELS Present" criteria will apply from April through September for a warmwater sport classification.

The "default" basin assumed values are used for Temperature, pH and background ammonia concentrations, because minimum ambient data is available. These values are shown in the table below, with the resulting criteria and effluent limitations.

Weekly and Monthly Ammonia Nitrogen Limits

		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
Effluent Flow	Qe (MGD) 002	0.51	0.51	0.51
	Qe (MGD) 003	0.0016	0.0016	0.0016
Background Information	7-Q_{10} (cfs)	11.8	11.8	11.8
	7-Q_2 (cfs)	18.7	18.7	18.7
	Ammonia (mg/L)	0.04	0.05	0.105
	Average Temperature (°C)	12	19	4
	Maximum Temperature (°C)	14	21	10
	pH (s.u.)	8.04	8.08	7.99
	% of Flow used	50	100	25
	Reference Weekly Flow (cfs)	5.9	11.8	2.95
	Reference Monthly Flow (cfs)	7.95	15.9	3.97
Criteria mg/L	4-day Chronic			
	Early Life Stages Present	5.74	3.66	
	Early Life Stages Absent			8.26
	30-day Chronic			
	Early Life Stages Present	2.30	1.46	
	Early Life Stages Absent			3.30
Outfall 002 Effluent Limitations mg/L	Weekly Average			
	Early Life Stages Present	48.3	57.7	
	Early Life Stages Absent			38.7
	Monthly Average			
	Early Life Stages Present	25.0	30.0	
	Early Life Stages Absent			19.4
Outfall 003 Effluent	Weekly Average			
	Early Life Stages Present	13,586	17,222	

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		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
Limitations mg/L	Early Life Stages Absent			9,725
	Monthly Average			
	Early Life Stages Present	7,243	9,086	
	Early Life Stages Absent			5,138

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from 04/03/2017 to 09/26/2021, with those results being compared to the calculated limits to determine the need to include ammonia limits in Johnsonville's permit. That need is determined by calculating 99th upper percentile (or P_{99}) values for ammonia and comparing the daily maximum values to the daily maximum limit.

Outfall 002	Ammonia Nitrogen mg/L
1-day P_{99}	3.2
4-day P_{99}	1.7
30-day P_{99}	0.86
Mean	0.51
Std	0.66
Sample size	168
Range	0.079 – 5
Outfall 003	Ammonia Nitrogen mg/L
03/22/2021	0.667

Based on this comparison, there is **no reasonable potential for the discharge to exceed any of the calculated ammonia nitrogen limits.**

The current permit has a daily maximum limit of 8.0 mg/L and a monthly average limit of 4.0 mg/L year round for Outfall 002. This is based on categorical requirements per ch. NR 258 Wis. Adm. Code for meat processing facilities. The TBEL memo dated 11/09/2021 recommends a continuation of the monthly average limit of 4.0 mg/L. Therefore, **the current monthly average limit for Outfall 002 is recommended to be included in the reissued permit.**

Monitoring for Outfall 003 is not recommended in the reissued permit.

Conclusions and Recommendations

In summary, after rounding to two significant figures, the following ammonia nitrogen limitations are recommended. No mass limitations are recommended in accordance with s. NR 106.32(5), Wis. Adm Code.

Final Ammonia Nitrogen Limits

	Daily Maximum mg/L	Monthly Average mg/L
Year round	8.0	4.0

PART 5 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

Bacteria limits only apply to Outfall 002 because process and sanitary wastewaters from the community of Johnsonville are discharged through this outfall.

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Codes, became effective which replace fecal coliform limits with new *Escherichia coli* (*E. coli*) limits for protection of recreational uses. Section NR 210.06(2)(a)1, Wis. Adm. Code, includes two limits which must be included in permits for facilities which are required to disinfect:

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

E. coli monitoring is recommended at the same frequency that fecal coliform monitoring is required in the current permit. Because Johnsonville's permit requires weekly monitoring, the 410 counts/100 mL limit will effectively function as a daily maximum limit unless the facility performs additional monitoring. Any additional monitoring beyond what is required by the permit must also be reported on the DMR as required in the standard requirements section of the permit.

These limits are required during May through September.

Interim Limit
At this time, there is no effluent *E. coli* data available to determine if these limits are currently met. The permit will include a compliance schedule to meet these limits. During the compliance schedule, an interim limit applies to prevent back-sliding from the current level of disinfection. Therefore, the current **fecal coliform limit shall be included in the reissued permit as an interim limit of 400 counts/100 mL as a daily maximum and monthly geometric mean**.

These fecal coliform limits are recommended to continue beyond the effective date of the *E. coli* limits because Johnsonville is subject to the requirements in NR 258 Wis. Adm. Code for meat processors. **The current fecal coliform limits apply year-round.**

PART 6 – PHOSPHORUS

Technology-Based Effluent Limit
Subchapter II of Chapter NR 217, Wis. Adm. Code, requires industrial facilities that discharge greater than 60 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Outfall 002
Because Johnsonville currently has a limit of 1.0 mg/L at Outfall 002, this limit should be included in the reissued permit. This limit remains applicable unless a more stringent WQBEL is given.

Outfall 003

Because Outfall 003 does not currently have an existing technology-based limit, the need for this limit in the reissued permit is evaluated. The data demonstrates that the annual monthly average phosphorus loading is less than/greater than 60 lbs/month, which is the threshold for industrial facilities in accordance to s. NR 217.04(1)(a)2, Wis. Adm. Code, and therefore **no technology-based limit is required.**

Annual Average Mass Total Phosphorus Loading

Month	Monthly Avg. mg/L	Total Phosphorus lb./mo.
Aug 2020	0.042	0.00056
Sept 2020	0.068	0.00091
Oct 2020	0.038	0.00051
Nov 2020	0.025	0.00033
Average		0.00058

Total P (lbs/month) =
Monthly average (mg/L) × maximum annual average flow (MGD) × 8.34 (lbs/gallon) × 30 (day/month)

In addition, the need for a WQBEL for phosphorus must be considered.

Water Quality-Based Effluent Limits (WQBEL)
Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

Section NR 102.06(3)(a), Wis. Adm. Code, specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), Wis. Adm. Code, s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.1 mg/L applies for the Sheboygan River.

The conservation of mass equation is described in s. NR 217.13(2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs) provided below.

$$\text{Limitation} = [(WQC)(Qs+(1-f)\ Qe) - (Qs-f\ Qe)\ (Cs)]/Qe$$

Where:

WQC = 0.1 mg/L for the Sheboygan River
Qs = 100% of the 7-Q_2 of 18.7 cfs
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code
Qe = effluent flow rate = 0.51 MGD = 0.789 cfs
f = the fraction of effluent withdrawn from the receiving water = 0

Section NR 217.13(2)(d), Wis. Adm. Code, specifies that the background phosphorus concentration used in the limit calculation formula shall equal the median of at least four samples collected during the months of May through October, and that all samples collected during a 28-day period shall be considered as a single sample and the average of these concentrations used to determine a median. Averaging begins at date of the first sample in the range of May through October.

A previous evaluation resulted in a WQBEL of 0.10 mg/L using a background concentration of 0.167 mg/L. Section NR 217.13(2)(d), Wis. Adm. Code, states that the determination of upstream concentrations shall be evaluated at each permit reissuance. Additional data were considered in estimating the background phosphorus concentration.

A review of all available in stream total phosphorus data from 05/23/2013 to 10/18/2018 (12 samples) stored in the Surface Water Integrated Monitoring System database indicates the median background total phosphorus concentration in the Sheboygan River at Cty Hwy JM (SWIMS station ID 603217) is 0.206 mg/L, just upstream from the point of discharge.

Substituting a background concentration above criteria into the limit calculation equation above would result in a calculated limit that is less than the applicable criterion of 0.1 mg/L. However, s. NR 217.13(7), Wis. Adm. Code, specifies that "if the WQBEL calculated pursuant to the procedures in this section is less than the phosphorus criterion specified in s. NR 102.06, Wis. Adm. Code, for the water body, the effluent limit shall be set equal to the criterion."

Effluent Data
The following table summarizes effluent total phosphorus monitoring data for Outfalls 002 and 003.

Total Phosphorus Effluent Data

	Outfall 002 Phosphorus mg/L	Outfall 003 Phosphorus mg/L
1-day P_{99}	1.6	0.14
4-day P_{99}	0.90	0.09
30-day P_{99}	0.52	0.06
Mean	0.35	0.04
Std	0.33	0.03
Sample size	236	12
Range	0.029 – 3.2	<0.022 – 0.12
Dates	04/03/2017 – 09/27/2021	08/25/2020 – 11/11/2020

Outfall 003
Reasonable Potential Determination
The discharge from Outfall 003 does not have reasonable potential to cause or contribute to an exceedance of the water quality criterion because the 30-day P_{99} of reported effluent total phosphorus data is less than the calculated WQBEL**.** Therefore, **a WQBEL is not required. Monitoring in the reissued permit is recommended** to determine the need for limits at the next permit reissuance.

Outfall 002
Reasonable Potential Determination
The calculated WQBEL of 0.1 mg/L is less than the current technology-based limit of 1.0 mg/L, so the WQBEL must be included in the permit per s. NR 217.15(2), Wis. Adm. Code.

In accordance with s. NR 217.15(1), Wis. Adm. Code, there is reasonable potential for the discharge to cause or contribute to an exceedance of the water quality criteria. The data suggest that a compliance schedule will be necessary for the facility to meet the given phosphorus limits.

Limit Expression
According to s. NR 217.14(2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.1 mg/L may be expressed as a six-month average. If a concentration limitation expressed as a six-month average is included in the permit, a monthly average concentration limitation of 0.3 mg/L, equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code shall also be included in the permit. The six-month average should be averaged during the months of May – October and November – April.

Mass Limits
A mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code, because the discharge is to a surface water that is to or upstream of a phosphorus-impaired water. **This final mass limit shall be 0.1 mg/L × 8.34 × 0.51 MGD = 0.425 lbs/day expressed as a six-month average.**

Multi-Discharge Variance Interim Limit
With the permit application, Johnsonville has applied for the phosphorus multi-discharger variance (MDV). Conditions of the phosphorus MDV require the facility to comply with an interim phosphorus limit in lieu of meeting the final WQBEL for this permit term. The recommended interim limit, pursuant to s. 283.16 (6) 1, Wis. Stats., is 0.8 mg/L as a monthly average. A compliance schedule may be appropriate to meet this interim limit, but compliance with 0.8 mg/L shall be no later than the end of the reissued permit.

The effluent data indicates that **1.0 mg/L is a level currently achievable (LCA)** for the discharge, equal to the current interim limit. A limit of 1.0 mg/L as a monthly average should not be exceeded during the compliance schedule.

TMDL Under Development
A Total Maximum Daily Load (TMDL) is being developed for the Northeast Lakeshore for phosphorus. The TMDL will address phosphorus water quality impairments within the basins and provide waste load allocations (WLA) required to meet water quality standards. This TMDL will likely result in phosphorus limitations that must be included in WPDES permits, which may be different than those calculated in this WQBEL memo. TMDL-derived phosphorus limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.

PART 7 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is

used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from 04/01/2017 to 09/30/2021.

The table below summarizes the maximum temperatures reported during monitoring from 04/03/2017 to 03/27/2019.

Monthly Temperature Effluent Data & Limits – Outfall 002

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	64	65	NA	120
FEB	65	67	NA	120
MAR	68	71	NA	120
APR	71	72	102	120
MAY	76	79	113	120
JUN	75	76	NA	120
JUL	80	80	NA	120
AUG	79	81	NA	120
SEP	79	80	NA	120
OCT	66	71	NA	120
NOV	65	67	114	120
DEC	72	75	NA	120

Monthly Temperature Effluent Data & Limits – Outfall 003

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	47	47	NA	120
FEB	51	51	NA	120
MAR	60	60	NA	120
APR	60	61	NA	120
MAY	60	60	NA	120
JUN	62	63	NA	120
JUL	62	62	NA	120
AUG	66	66	NA	120
SEP	62	66	NA	120
OCT	59	59	NA	120

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Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
NOV	53	53	NA	120
DEC	49	49	NA	120

Reasonable Potential
Permit limits for temperature are recommended based on the procedures in s. NR 106.56, Wis. Adm. Code.

- An acute limit for temperature is recommended for each month in which the representative daily maximum effluent temperature for that month exceeds the acute WQBEL. The representative daily maximum effluent temperature is the greater of the following:
  (a) The highest recorded representative daily maximum effluent temperature
  (b) The projected 99th percentile of all representative daily maximum effluent temperatures
- A sub−lethal limitation for temperature is recommended for each month in which the representative weekly average effluent temperature for that month exceeds the weekly average WQBEL. The representative weekly average effluent temperature is the greater of the following:
  (a) The highest weekly average effluent temperature for the month.
  (b) The projected 99th percentile of all representative weekly average effluent temperatures for the month

Based on the available effluent data no effluent limits are recommended for temperature. The complete thermal table used for the limit calculation is attached. **Monitoring is recommended to continue in the reissued permit for Outfall 002.**

PART 8 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the *Whole Effluent Toxicity (WET) Program Guidance Document (October 29, 2019).*

Outfall 003

- Chronic testing is usually not recommended where the ratio of the 7-Q_{10} to the effluent flow exceeds 100:1 and acute testing is not typically recommended if the ratio exceeds 1000:1. For Outfall 003, that ratio is approximately 4770:1. With this amount of dilution, there is believed to be little potential for acute or chronic toxicity effects in Sheboygan River associated with the discharge from Johnsonville, so the need for acute and chronic WET testing for Outfall 003 will not be considered

further.

Outfall 002

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.
- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09(3)(b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The **IWC of 21%** shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

$$IWC\ (as\ \%) = Q_e \div \{(1 - f)\ Q_e + Q_s\} \times 100$$

Where:

Q_e = annual average flow = 0.51 MGD = 0.789 cfs
f = fraction of the Q_e withdrawn from the receiving water = 0
Q_s = ¼ of the 7-Q_{10} = 11.8 cfs ÷ 4 = 2.95 cfs

*The IWC decreased slightly since the last reissuance because the expected maximum annual effluent average flow decreased.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.
- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 002 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.
- Shown below is a tabulation of all available WET data for Outfall 002. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations. Johnsonville completed upgrades in the fall of 2014 at both treatment facilities. Therefore, the results prior to this upgrade are not representative of current conditions and not included in this evaluation.

WET Data History – Outfall 002

Date Test Initiated	Acute Results LC_{50} %				Chronic Results IC_{25} %				Footnotes or Comments
	C. dubia	Fathead minnow	Pass or Fail?	Used in RP?	*C. dubia*	Fathead Minnow	Pass or Fail?	Use in RP?	
12/09/2014	>100	>100	Pass	Yes	52.2	>100	Pass	Yes	
02/02/2016	>100	>100	Pass	Yes	91.9	99	Pass	Yes	

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Date Test Initiated	Acute Results LC_{50} %				Chronic Results IC_{25} %				Footnotes or Comments
	C. dubia	Fathead minnow	Pass or Fail?	Used in RP?	*C. dubia*	Fathead Minnow	Pass or Fail?	Use in RP?	
04/25/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/14/2017	82	>100	Fail	No	76.2	>100	Pass	No	1
12/13/2017	>100	>100	Pass	Yes					
07/31/2018	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/12/2019	>100	>100	Pass	Yes	61.5	>100	Pass	Yes	
01/28/2020	>100	>100	Pass	Yes	50.2	>100	Pass	Yes	
04/06/2021	>100	>100	Pass	Yes	59.5	>100	Pass	Yes	

Footnotes:

1. This test was immediately after a period of longer than usual production shut down and cleaning process and the sanitation wastewater was mixed with very little production wastewater. Under normal conditions, the sanitation wastewater is mixed with a much higher amount of other wastewater.

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.**

  Acute Reasonable Potential = [(TUa effluent) (B)(AMZ)]
  Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

  According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUc effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC_{50}, IC_{25} or $IC_{50} \geq 100\%$).

  Acute Reasonable Potential = $0 < 1.0$, reasonable potential is not shown, and a limit is not required.

  Chronic Reasonable Potential = [(TU_c effluent) (B)(IWC)]

Chronic WET Limit Parameters

TUc (maximum) $100/IC_{25}$	**B** (multiplication factor from s. NR 106.08(6)(c), Wis. Adm. Code, Table 4)	IWC
100/50.2 = 2.0	2.3 Based on 5 detects	21%

[(TUc effluent) (B)(IWC)] = $0.96 < 1.0$

The current limit for chronic WET testing is 4.0 TUc which should be continued in the reissued permit. If Johnsonville would like to request the removal of the existing limit, an assessment of their effluent data consistent with the requirements of ss. NR 207.04(1)(a) and (c), Wis. Adm. Code, must be provided. Without a demonstration of need for a higher limit in accordance with s. NR 207.04, Wis. Adm. Code, the current limit of 4.0 TU_c must be continued in the reissued permit. The Department would be unable to

increase or remove the limit due to the lack of need as shown via the antidegradation rule (ch. NR 207, Wis. Adm. Code). **Therefore, the current limit of 4.0 TUc and the current IWC of 25% is recommended to continue in the reissued permit.**

The WET checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET checklist, see Chapter 1.3 of the WET Guidance Document: https://dnr.wisconsin.gov/topic/Wastewater/WET.html.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not Applicable. **0 Points**	IWC = 25%. **0 Points**
Historical Data	8 tests used to calculate RP. No tests failed. **0 Points**	7 tests used to calculate RP. No tests failed. **0 Points**
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. **0 Points**	Same as Acute. **0 Points**
Receiving Water Classification	Warmwater sport fish **5 Points**	Same as Acute. **5 Points**
Chemical-Specific Data	Reasonable potential for limits for no substances based on ATC; Ammonia nitrogen limit carried over from the current permit. Ammonia, chloride, chromium, copper, nickel, and zinc detected. Additional Compounds of Concern: None **3 Points**	Reasonable potential limits for no substances based on CTC; Ammonia nitrogen limit carried over from the current permit. Ammonia, chloride, chromium, copper, nickel, and zinc detected. Additional Compounds of Concern: None **3 Points**
Additives	0 Biocides and 6 Water Quality Conditioners added. P treatment chemical other than Ferric Chloride (FeCl), Ferrous Sulfate ($FeSO_4$), or alum used: No **6 Points**	All additives used more than once per 4 days. **6 Points**
Discharge Category	Private meat industry **5 Points**	Same as Acute. **5 Points**
Wastewater Treatment	Secondary or better **0 Points**	Same as Acute. **0 Points**

	Acute	Chronic
Downstream Impacts	No impacts known **0 Points**	Same as Acute. **0 Points**
Total Checklist Points:	**19 Points**	**19 Points**
Recommended Monitoring Frequency (from Checklist):	2/permit term	None
Limit Required?	No	No
TRE Recommended? (from Checklist)	No	No

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2019) and other information described above, 2/permit acute and annual chronic WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).
- **A minimum of annual chronic monitoring is required because a chronic WET limit is required.** Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present.

PART 9 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code, align Wisconsin's WQBELs with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

Johnsonville is an industrial discharge and is therefore subject to daily maximum and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, pH, and *E. coli* among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for Calculation

The methods for calculating limitations for industrial discharges to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(4), Wis. Adm. Code, as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
2. Whenever a weekly average limitation is determined necessary to protect water quality:
    - A monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.

- Outfall 002: BOD_5 – The current weekly average limits for the months of June – November and December – February are more restrictive than the year-round monthly average limit of 232 lbs/day. Therefore, the monthly average limits for these months are recommended to be equal to the current weekly average limits of 88 lbs/day for June – November and 219 lbs/day for December – February.

Summary of Additional Limitations:
In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code.

Expression of Limits Summary

Parameter	Daily Maximum	Weekly Average	Monthly Average
BOD_5	464 lbs/day		
March – May		262 lbs/day	232 lbs/day
June – November		88 lbs/day	**88 lbs/day**
Dec – February		219 lbs/day	**219 lbs/day**

PART 10 – ADDITIVE REVIEW

Unlike the metals and toxic substances evaluated in Part 2, most additives have not undergone the amount of toxicity testing needed to calculate water quality criteria. Instead, in cases where the minimum data requirements necessary to calculate a WQC are not met, a secondary value can be used to regulate the substance, according to s. NR 105.05, Wis. Adm. Code. Whenever an additive is discharged directly into a surface water without receiving treatment or an additive is used in the treatment process and is not expected to be removed before discharge, a review of the additive is needed. Secondary values should be derived according to s. NR 105.05, Wis. Adm. Code. Guidance related to conducting an additive review can be found in *Water Quality Review Procedures for Additives* (2019) (http://dnr.wi.gov/topic/wastewater/Guidance.html).

Additive Parameters

Additive Name	Manufacturer	Purpose of Additive including where added	Intermittent or Continuous Feed	Frequency of Use		Estimated Effluent Concentration mg/L	Potential Use Restriction mg/L[1] based on secondary chronic value	Is Additive Authorized in Current Permit?[2]
				Months per/yr.	Days/ week			
Suppressor 1157	Hydrite Chemical Co.	Anti-foam agent	Continuous	12	7	0.87 mg/L	6.7	Yes

1. Calculated based on toxicity data provided

The estimated effluent concentrations of Suppressor 1157 in the discharge from Outfall 002 are much lower than the calculated limit for protection of aquatic life. Therefore, this additive is approved at the listed usage rates.

Attachment #2

Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

						Temp Dates	Flow Dates
Facility:	Johnsonville LLC		**7-Q_{10}:**	11.80	cfs		
Outfall(s):	002		**Dilution:**	50%		**Start:**	04/03/17	04/01/17
Date Prepared:	11/5/2021		**f:**	0		**End:**	03/27/19	09/30/21
Max Annual Ave (Qe):	0.51	MGD	**Stream type:**	Small warm water sport or forage fish co			
Storm Sewer Dist.	0	ft	**Qs:Qe ratio:**	7.5	:1		
			Calculation Needed?	YES			

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs)	Representative Highest Effluent Flow Rate (Qe)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(cfs)	(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	33	49	76	11.80	0.573	0.779	0	64	65	NA	120
FEB	34	50	76	11.80	0.561	0.810	0	65	67	NA	120
MAR	38	52	77	11.80	0.587	0.861	0	68	71	NA	120
APR	48	55	79	11.80	0.562	0.792	0	71	72	102	120
MAY	58	65	82	11.80	0.552	0.845	0	76	79	113	120
JUN	66	76	84	11.80	0.589	0.763	0	75	76	NA	120
JUL	69	81	85	11.80	0.592	0.871	0	80	80	NA	120
AUG	67	81	84	11.80	0.604	0.804	0	79	81	NA	120
SEP	60	73	82	11.80	0.567	0.908	0	79	80	NA	120
OCT	50	61	80	11.80	0.551	0.730	0	66	71	NA	120
NOV	40	49	77	11.80	0.530	0.772	0	65	67	114	120
DEC	35	49	76	11.80	0.549	0.695	0	72	75	NA	120

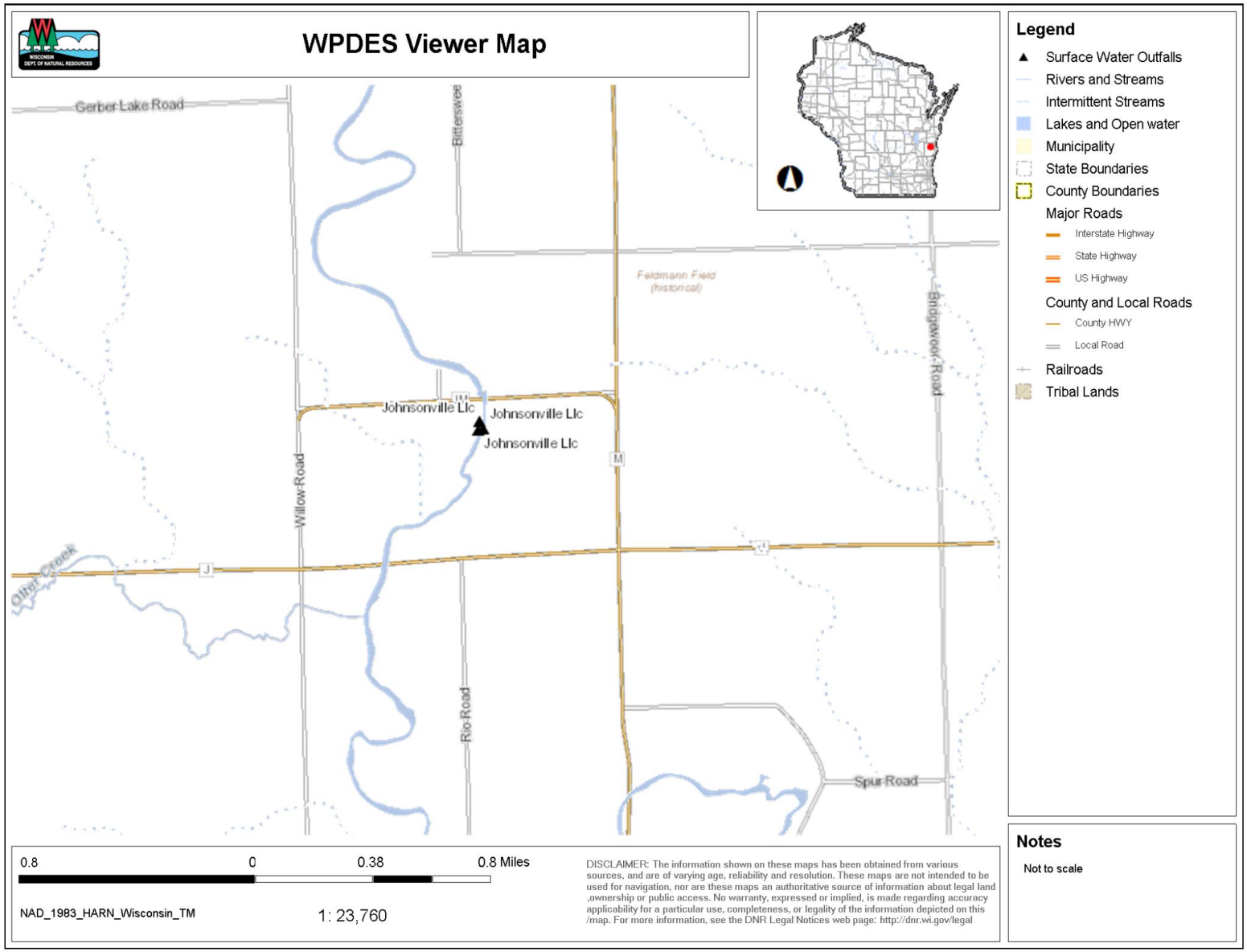
Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

						Temp Dates	Flow Dates
Facility:	Johnsonville LLC		**7-Q_{10}:**	11.80	cfs		
Outfall(s):	003		**Dilution:**	25%		**Start:**	05/06/19	01/00/00
Date Prepared:	11/5/2021		**f:**	0		**End:**	09/27/21	01/00/00
Max Annual Ave (Qe):	0.0016	MGD	**Stream type:**	Small warm water sport or forage fish co			
Storm Sewer Dist.	0	ft	**Qs:Qe ratio:**	1191.6	:1		
			Calculation Needed?	NO			

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs)	Representative Highest Effluent Flow Rate (Qe)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(cfs)	(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	33	49	76	11.80	0.000	0.000	0	47	47	NA	120
FEB	34	50	76	11.80	0.000	0.000	0	51	51	NA	120
MAR	38	52	77	11.80	0.000	0.000	0	60	60	NA	120
APR	48	55	79	11.80	0.000	0.000	0	60	61	NA	120
MAY	58	65	82	11.80	0.000	0.000	0	60	60	NA	120
JUN	66	76	84	11.80	0.000	0.000	0	62	63	NA	120
JUL	69	81	85	11.80	0.000	0.000	0	62	62	NA	120
AUG	67	81	84	11.80	0.000	0.000	0	66	66	NA	120
SEP	60	73	82	11.80	0.000	0.000	0	62	66	NA	120
OCT	50	61	80	11.80	0.000	0.000	0	59	59	NA	120
NOV	40	49	77	11.80	0.000	0.000	0	53	53	NA	120
DEC	35	49	76	11.80	0.000	0.000	0	49	49	NA	120

Attachment #3



Johnsonville LLC